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Usability and Accessibility Model for E-Government Websites in Ethiopia

ABSTRACT

The development of websites and portals are main components of the e-Government strategy implementations for the last nine years in Ethiopia. However, services optimizations with usability and accessibility are key issues of Ethiopia e-Government services development.

Therefore, the ultimate goal of this study is creation of usable, accessible and sustainable Ethiopian e-Government websites with four stage of research analysis, through proposed model. The investigations results are used to provide a clear picture of what needs to be improves from management and user point of views and also from other stakeholders of e-Government services. This study applies mixed methods of data collection and analysis, that integrating quantitative and qualitative data, using questionnaires' and interviews to identify the key usability and accessibility issues of Ethiopia e-Government websites services. The data collection and analysis are primarily from management and users' point of views are analyzed and discussed and also interpretations of the data are presented using factor analysis and other analytical techniques. Afterward, expert based e-Government website evaluations are presented and discussed using heuristics evaluation principles'. Finally, automatics accessibility evaluation based on WCAG 2.1 guidelines using online WAVE Accessibility Tool assessment results are analyzed, presented and discussed.

Keywords

e-Government websites, usability and accessibility evaluation, usability and accessibility gaps, disability, Heuristics, WAVE, proposed model

1. INTRODUCTION

1.1 Background

Web usability generally means that websites are clear, simple, consistent and easy for users to use (Cappel & Huang, 2007). Evaluating the usability an accessibility of government website helps to learn effectiveness and efficiency of web usage and improve user satisfaction and government services. The primary focus of evaluating the usability is on the elements of learnability, memorability, effectiveness, efficiency and satisfaction for all portal/website developers and users (ISO-9241-210, 2010). Like

usability, accessibility is usually refers to the use of websites or e-Systems by people with special needs, particularly those with disabilities and older people ISO 9241-171 (2008b).

1.2 Statement of the Problem

Research is needed to investigate and proposing which usability and accessibility evaluation method can be appropriate for e-Government website/portal. This sort of research can help Ethiopia e-Government website improving its usability and accessibility of application and in order keeping smooth operation of government electronic activities from different perspectives. Furthermore, the research may provide an opportunity for academia to consider specific usability and accessibility evaluation solutions for e-Government web based electronic services.

The National ICT Growth and Transformation Plan (GTP) of Ethiopia in its annual report from 2010 up to now, there is no stated report related to e-Government websites usability and accessibility evaluations studies, level of end-user involvement, and its impact assessment from services users' perspectives (FDRE, GTPII, 2016).

According to Teka, et al. (2016) in Ethiopia software usability including portal-based system is neither well addressed in software practice nor at the policy making level. Software practitioners focus on functional requirements, meeting deadline sand budget. The report shows that implementation and usability of Ethiopia e-Government services also face many problems and other studies indicate that there is little or fragmented effort to overcome problems related to usability and accessibility of e-Government services based on users' needs and perspectives (Aserat, 2017).

This research study assesses the usability and accessibility of websites. Moreover, the study proposes usability and accessibility evaluation model of Ethiopia e-government websites. Therefore, aims to answer the following research questions:

- What kinds of usability and accessibility problems exist with Ethiopia e-Government websites that violate website development standards?
- How make usable and accessible Ethiopian e-Government websites?
- What kind of websites usability and accessibility model can be proposed in Ethiopian context?

1.3 Objective of the Study

1.3.1 General Objective

The general objective of this research study is to propose Ethiopia e-Government Websites Usability and Accessibility Model (WUAM) for improving the usability and accessibility of the e-Government websites

1.3.2 Specific Objective

- To identify and put forward the usability and accessibility of Ethiopia e-Government websites problems and standards violated by e-Government websites for improving performance.
- To understand and explain usability status of e-Government websites from end-users and management perspectives.
- To improve the e-Government websites user interface and layout design and
- To adapt and propose e-Government websites usability and accessibility model for an effective and easy roadmap of websites in Ethiopian context.

1.4 Scope and Coverage

The scope of this study is to evaluate the usability and accessibility problems of Ethiopia e-Government websites/portals platform, from users and managements perspectives, expert based and automatics tools evaluation. Finally, proposing Ethiopia e-Government website usability and accessibility roadmap model.

It mainly focused on and covers 34 Ethiopian government institutes (Ministries, Agencies and Authorities) portals and websites services. Those are from the e-Government strategy development result of web based informational and transactional E-Services.

1.5 Significance of Research Study

The result of this research revealed the challenges which hinder the usability and accessibility of the Ethiopian e-Government websites and portals. Those in turn to identify key usability and accessibility problems and used to provide a clear picture of what needs to be improves from user and management point of views. The results also help the management, decision makers and developers to assess the factors which contribute positively to the effectiveness and efficiency of the e-Government websites and portals. Thirdly, the results of the study are evaluated and improve the usability and accessibility of the e-Government websites with the proposed model in Ethiopia context.

2. RESEARCH DESIGN AND METHODOLOGY

2.1 Research Strategy

The methodology that is used to achieve the objective of the study is first, general research strategy and design are described. Next, research techniques with four stages of evaluation with different perspectives data collection procedures are discussed. Finally, population of the study, sampling techniques, sample size, data collection instrument and procedure, pilot study and data analysis methods are discussed.

The general research strategies and methods were used in gathering the needed information include the following:

- Through questionnaire from IT managements and senior e-Government project coordinator experts, who able to provide information on e-Government services and from users, clients and visitors to obtain a real-world sense of the context on the issue of Ethiopia e-Government websites usability;
- Through interview with executive's IT management actively involved in the issue of e-Government (all sides and perspectives);
- Conduct expert-based information gathering using heuristic evaluation principles and
- Carry out automatic accessibility evaluation tools to obtain the clearest possible picture of e-Government website services accessibility problems.

2.2 Research Design

The researcher has used mixed methods of research that advances the systematic integration or mixing of quantitative and qualitative data within a single investigation or sustained program of inquiry (Jennifer & John W, 2013). Through qualitative research type we can analyses the various factors (issues) which motivate people to behave in a particular approach of e-Government web-based services or which make people like or dislike a particular standard of website.

2.3 Research Techniques

As indicated previously, the study was based on Ethiopia e-Government websites and portal service, in four stage study analysis with detail of behavior and instruments used in performing research operations is presented from Management and User Perspective, End-user's perspective, Expert-Based Evaluation and Automated Accessibility Evaluation Tools was applied.

2.3.5 Research Population and Sample Size

The study involved five government organisations' information technology development division directors, managers, team leaders and IT senior professionals'/coordinators, and all were responsible for the uptake of e-Government service development in the institutes. Moreover, the sampling technique for the selection of those information technology department managers of the organization was purposive or deliberate selection sampling, because the target populations of the study were arranged based on a factor that was influenced the measures and the analysis results.

The table 3.1 below show the participant of the study and five government institutions' information technology development division managements were selected; based on number of web based

transactional electronics services they used and their functionality. This means 14.71% from the total population of 34 organizations websites/portals based informational and transactional services providers.

Table 3.1 Participant of the study and selected institutes e-Government websites/portals

S N	Organization	Type	# of e- Services	Participant of the Study				
				Management Perspectives		users Perspectives	Expert Based Evaluation	Automatics Accessibility Evaluation
				for questionnaire	for interview	for questionnaire		
1.	Ministry of Trade (www.mot.gov.et)	Ministry	7	8	1	25	Five IT experts based on Jakob Nielsen's heuristic evaluation principles were selected. The evaluation was done on National gov't portal of www.ethiopia.gov.et	The researcher of this study was done the evaluation activities, based on W3C, WCAG 2.1 Using WAVE accessibility tools. The assessment was done on five gov't portals
2.	Public Servants Social Security Agency (www.pssa.gov.et)	Agency	6	8	1	25		
3.	Ministry of Foreign Affairs (www.mofa.gov.et)	Ministry	6	8	1	25		
4.	Ministry of Communication and Information Technology (www.mcit.gov.et)	Ministry	10	8	1	25		
5.	Federal Transport Authority (www.fta.gov.et)	Authority	18	8	1	25		
Total				40	5	125	5	1

The sample number of participants' management and head expert from the five selected government organizations were 40. Which have been seven IT management members and head IT professional expert from each organization, for questionnaire-based data collection instrument. For the qualitative study, IT management members and directors were selected and interviewed to gather their experiences and insights.

The second stage of this study was to build a clear overview about the issues of Ethiopia e-Government websites/portals usability from the perspective of service uses, because the role of the end-users or visitors was restricted in the other evaluation methods.

3.4. Data Collection Instrument

The instruments used for collecting the required data were questionnaire and interview. The data collection instruments are further described below:

3.4.1 Questionnaire Structure

On the basis of usability test and guidelines for usability evaluation questionnaire was adopted from Lewis (1995) "IBM usability satisfaction questionnaires" model. The adopted questionnaires some parts

were reviewed and minor modifications were done by the researchers to measure the content validity and design analysis based on Ethiopia government administrations systems and citizen culture. The verification of those modified questionnaires structure was done using pilot test, before the main data collection took place.

The questionnaire was self-administered by the participant answers the questions alone or the questionnaire administrates by authors asked participant question by questions. In addition to this, by mailing of questionnaires /on-line questionnaires/ using Google form, as shown below link address, using my Gmail account (yosroof@gmail.com) were designed and sent to the participant of the study:

- By mailing /on-line/ of questionnaires for management

[<https://docs.google.com/forms/d/e/1FAIpQLSfvuxzOp5CzxEUaYHk9-jseJmgge474w2vbCb2wYbh02zX0Qw/viewform>]

- By mailing /on-line/ of questionnaires for user

[https://docs.google.com/forms/u/0/d/1ECpquxEHwIrAKhEAAmHQvWh5tfT7_eC8N_S5sG44gGM/edit?usp=forms_home&ths=true]

3.4.2 Interviews Questionnaire Structure

Sampling Technique and Procedure for the qualitative study of interviews were only those who serve as the head of IT departments were chosen using purposive sampling, because the participants were people who give inside and detail information about the study topic.

3.4.3 Heuristics based evaluation

The evaluators of the portal were five experts from information technology professional filed a minimum of four years or above work experience especially in web design and administration (Abdulhadi, Steve, & James, 2009). The Ethiopian government portal (www.ethiopia.gov.et) was selected for the experts'-based assessment, because it is national government portal.

3.5 Data Analysis

The collected data was analysed using Statistical Package for the Social Sciences (SPSS) version 25 for Windows, after logged and tracked on Microsoft Excel Sheet. Data analyses included reliability, correlation analysis, and multiple regressions. Descriptive statistics were used to describe the samples. The data was analysed using means, standard deviations, percentages, one-way ANOVA test and factor analysis.

Data cleaning or preprocessing was conducted for possible missing values and errors and duplicate data were identified. From the total number of 60 distributed questionnaires to the ICT managements, team leaders and senior IT head experts; 43 response questionnaires were collected. This indicates that the achievement of 107% out of 40 planed sampled data for management response rate. Moreover, from the total of 145 distributed questionnaires to users and visitors, 108 response questionnaires were collected. This indicates that the achievement of 86.4% out of 125 planed sampled data from end users' response rate for analysis of the study.

4. RESEARCH FINDINGS

Based on the analysis result of research findings for proposal of the model from each study perceptive, with the key issues of usability and accessibility problems have been discussed as shown below:

4.1. Management Perspectives Study

The main identified challenges from management perspectives study were user requirement gathering problems, and lack of integration and practices between e-Government websites development and usability main issues. The lack of encouragement and support for webmasters or employees to improving services usability and accessibility by offering any incentives mechanisms, poor e-Government usability and accessibility awareness level and also lack of guidelines and standards in the organizations were the major identified problems, from management perspectives of the study result. Therefore, e-Government ICT management, head experts and designers (webmasters) have significant impact to fill those identified gaps; as a result, they were one of the key identified components of the proposed model.

4.2 Users Perspectives Study

The e-Government services users' usability and accessibility assessments result shows that: there was main challenge and problems of websites services for users and visitors. In general, the study analysis results indicate there were many problems staring from the incentive of the projects up to final e-Government websites' project development and services provisions, as it discussed in chapter four of this study analysis sections and as summary reported in chapter six. The most highlighted problems were user requirement gathering problems; websites appearance was visually unattractiveness, too much inconsistency, icons and links poor standardization and, unreadable font and extra decorative styles and also lack of update information and content. Hence e-Government users and customers' feedback have significant impact to give feedback for those identified gaps; as a result, they were one of the key identified components of the proposed model.

4.3. Expert Evaluations Study

The study concluded using expert-based evaluation result shows that, Ethiopia e-Government portals identified problems were more related with the usability identified factors by end users and customers and violate different Jakob Nielsen's heuristics usability rule. Therefore, these makes those problems were the key and valid factors of the e-Government services success and also as means of faller.

4.4. Automatics Accessibility Evaluation

The assessments of the websites accessibility were done using online WAVE Accessibility Tool with aligned of W3C WCAG 2.1 guidelines. The final assessment results show that the current status of Ethiopia e-Government websites accessibility have lots of accessibility drawback, and violate accessibility standard requirements, as discussed in Chapter four.

Since, those identified problems using experts and automatics evaluations tools were the key issues of e-Government websites services for lack of usability and accessibility. Therefore organize "Usability & Accessibility Evaluator Committee" with different stakeholders and expertise groups were one component of the proposed model.

4.5. The Model

The Proposed Model for Ethiopian Government Organizations was for improving the usability and accessibility of their websites that will used as a roadmap for giving a solution for those identified problems of e-Government website. Moreover, it has facilitated impact of usable and accessible websites' services for government organizations.

In this study, the proposed e-Government websites usability and accessibility models were adapted from Jordan e-Government websites models. Considered that the Jordan e-Government websites' usability gaps were more related to this thesis study results and its models main components were more related with Ethiopian government organization ICT department structures.

Thus, the Jordan usability models has four components, however in the case of Ethiopian adapted e-Government website usability and accessibility model contain five main components: "Manager and Website Administrators"; "Users"; "Usability & Accessibility Evaluator Committee" /*lead by organization higher official's/ (stakeholders government institutes, public relation department, private sectors institutes)* "Public Relation and Communication Affairs Bureau" and "Development Process".

4.6. Ethiopia e-Government Website Usability and Accessibility Proposed Model

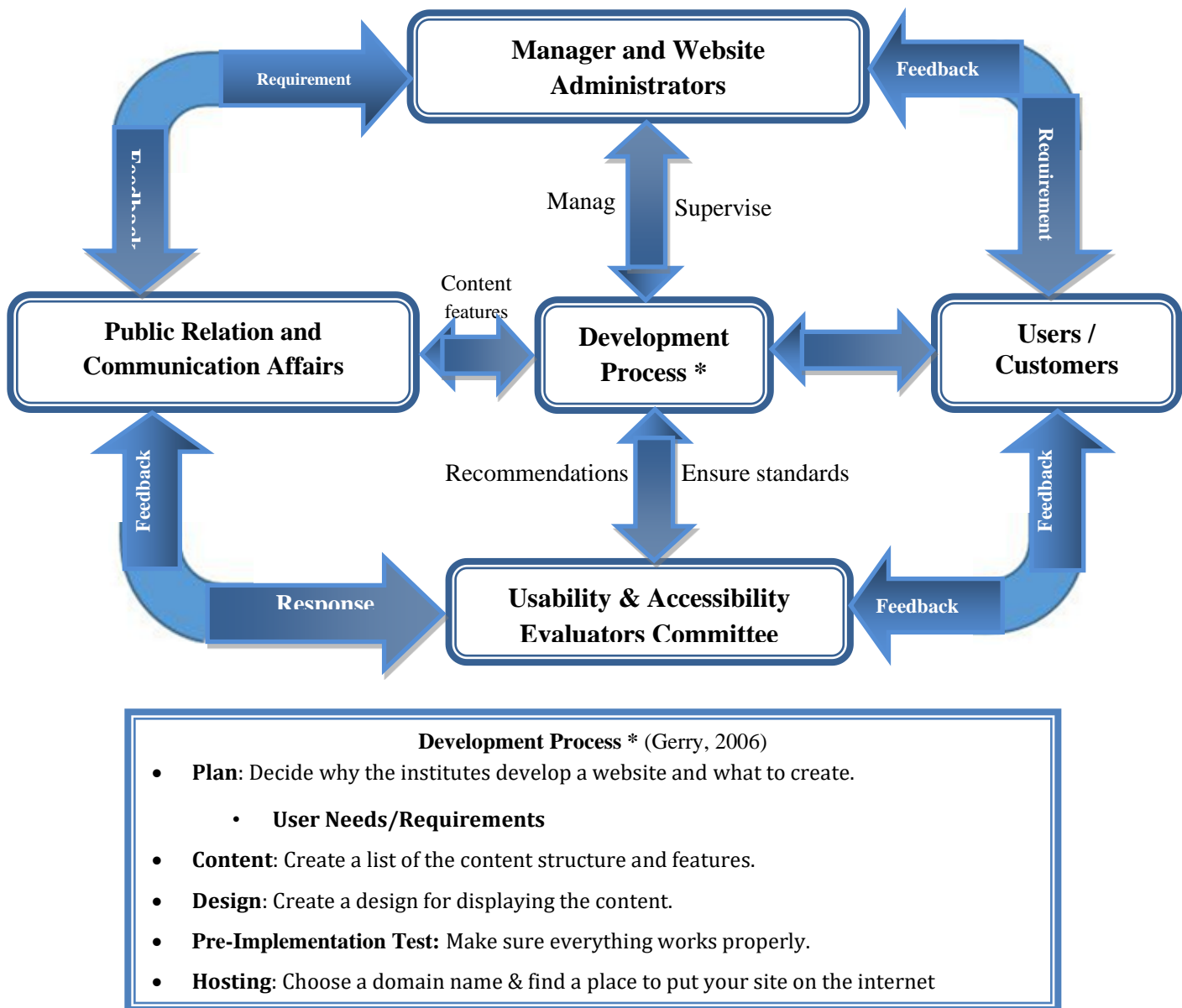


Figure 5.1: Ethiopia e-Government Website Usability and Accessibility Proposed Model

5. CONCLUSION

The aim of this research is to investigate the Ethiopia e-Government websites usability and accessibility problem with opportunities for improving performance. Furthermore, adapt and propose e-Government websites usability and accessibility model. With the aim of this research, we have used mixed methods of research study. In order to gets different sides' clear possible usability and accessibility issues: four stages

with different perspective study were implemented. Thus, management and user perspective evaluation study were applied and the data are collected using hard copy and on-line (mailing) questionnaires and semi-structured interviews. The sampling method for selection of organizations management and end-users are using purposive and convenience sampling selection method respectively.

Next, the experts-based evaluation using Jakob Nielsen's Heuristics evaluation rules are applied. The five senior website evaluators' experts were hired, for examine and assess the efficiency and functionality of user interface design and its usability of Ethiopian Government Portal (www.ethiopia.gov.et). All data collection sessions followed the same procedure, finally summary of each evaluator's main identified highlight issues on the violations of each heuristic principle were compiled and presented.

On the final stage, automatic web accessibility evaluations are applied. These web accessibility evaluation tools are used to check the e-Government website's accessibility level under standard web accessibility guidelines. In this study online WAVE Accessibility Tool is used, based on Web Content *Accessibility* Guidelines (WCAG) 2.1, and assessed the accessibility of sample selected Ethiopia e-Government website and portal.

Based on the above four stage investigations method, the final result of the study has contributed in presenting some essential findings related to Ethiopia e-Government websites usability and accessibility problem areas, and also proposed roadmap model that can play a major role towards future usable and accessible e-Government websites services. Moreover, the study results may aware all the stakeholders of Ethiopia e-Government websites and portals managements, webmasters, content publishers and developers. That gives more emphasis on usability and accessibility features which are often being neglected. The study results from each stage of investigations are summarized below.

Based on different perspective study result, e-Government services end-users of the research participants' point of view, the main identified Ethiopia e-Government websites usability issues are:

- The e-Government website dead links, under construction pages, no updated information and lack of equipped help and support services,
- E-Government websites were not design for all level of service users, uneasy and unattractive layout design. In addition, poor visual appeal of the site and inconsistency throughout the site,
- E-Government websites design and development problems and also not highlight the most important web contents,
- Web icons and links were not meaningful and information not available in the most native language of the citizen (language problems),
- Unclear navigation and link functionality on most of the e-Government websites pages,

- Lack of adequate website content and information organizations; such as the accuracy, quality, and freshness of news, information, and content on the website
- Lack of various functionality performances and features; like: the usefulness, convenience and variety of online features and tools available on the website, and
- Hard to find information and unreadable character of font size and formatting.

To conclude, usability is essential to satisfy user to return to the e-Government website over again. If user not able to use the website, they will move away. The most effective solution is to confirm usability issues which could create a website accessible and usable for the users. Nevertheless, most of the end users' participants in this research have "not satisfied" with the current services status of Ethiopian e-Government websites and raised many issues starting from users' requirement gathering to the final developed websites services.

Moreover, with the second stage of the study analysis result of management perspectives indicates that; the government organizations ICT management members and organization concerned bureau did not give enough attentions for those main e-Government website usability implementations issues and lack of usability awareness, guidelines and standards. In addition, managements notify end-users requirements problems, poor involvements of representative users, the content of the websites were not resourceful and lack of testing and monitoring of the websites were the main identified gaps of Ethiopia e-Government websites from management point of view.

Next, with the expert-based Jakob Nielsen's Usability Heuristics rule evaluation of e-Government website usability assessment result shows that: Error Prevention, Help and Documentation of important support information and FAQ, Consistency and Standards, Flexibility and Efficiency of Use, and Users Recognize, Diagnose, and Recover from Errors were expert based assessment main identified usability problems of e-Government websites. Therefore, the current status of Ethiopia e-Government websites violates most of usability heuristics rule.

Furthermore, based on international standards for the design of Web Content Accessibility Guidelines, using online WAVE accessibility tools assessment results shows that: the Ethiopia e-Government websites have many accessibility errors and did not conform to W3C Web Content Accessibility Guidelines (WCAG) 2.0 and e-Government websites functionality features were not capable for serving disabled persons. The most highlighted accessibility problems were: lack of equivalent alternatives texts, color and style sheets design problems, structural and features problems, unclear documents and content organizations; and redundancy and empty navigation, link and header of the e-Government website

services. Thus, these study results confirm that Ethiopian e-Government websites violate W3C Guidelines WCAG 2.0 standards.

At last, the aim of the study was achieved by conducting mixed and different sides' exhaustive survey, with suggested solution for improvement of Ethiopia e-Government website. Furthermore, establishing usability and accessibility roadmap model based on the study outcomes and Ethiopian context.

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